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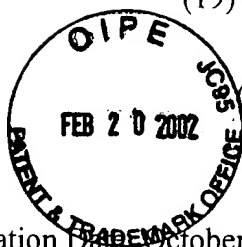
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(54) OPTICAL CALIBRATION STANDARD

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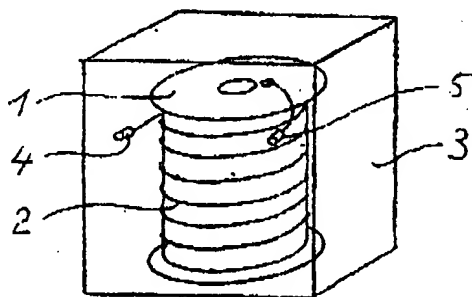
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ABSTRACT

The invention relates to an optical calibration standard, which is made of wound optical core (2) arranged with mechanical protection in a housing (3) and whose ends are accessible through optical connector outputs (4, 5). The consistency of the calibration data as a result is ensured over the long term, even under rough operating conditions, because the optical tube (2) contains an OWG [optical waveguide] (6), which is guided loosely and with excessive length within the sheath (7), because the OWG (6) ends with a hermetic seal in a connector pin (9) of a connector element (8), and because the sheath (7) is connected with hermetic seal to the connector element (8).

DESCRIPTION

The invention relates to an optical calibration standard, which consists of a wound optical core arranged, with mechanical protection, in a housing, and whose ends are accessible through optical connector outputs.

Such a calibration standard has been described in EP-A 2 04 037 and consists of the winding of an optical line, which presents increased optical damping and which can be connected through an optical connection element to an optical transfer line or to an optical apparatus to be calibrated. Although the optical line is mechanically protected in a housing, the winding located in the housing can undergo changes, for example, during transport. As a result, changes in the damping can occur, which are of course highly undesirable in a damping standard. Furthermore, environmental influences can chemically change the damping behavior of the optical line. For the known calibration standard, a special design of an optical line is needed.

The invention is based on the problem of improving the calibration standard of the type mentioned above, in such a manner that its calibration data remain unchanged over the long term even under rough conditions of operation. Furthermore, such a calibration standard should be developed so that it is suitable for the calibration of apparatuses for measuring optical waveguide damping, particularly for backscattering measuring apparatuses (OTDR=optical time domain reflector). In the case of use as a calibration standard for the OTDR, it must be possible to calibrate not only the damping indicator but also to conduct a calibration of the distance indicator.

The solution to this problem is that the optical tube contains an OWG, which is loosely led with excessive length in a sheath, and in that the OWG ends with a hermetic seal in the connector pin of a connector element, with the sheath being connected with a hermetic seal to the connector element.

For the solution according to the invention, it is possible to use commercial low-damping optical waveguides (OWG). Although, in this case, considerably higher lengths are required to reach a certain damping value than when a high-damping optical line, which has to be specifically prepared, is used. The sensitivity of an optical line itself is particularly increased under rough operating conditions if the line is very long. As a result of the guiding of the OWG in a sheath, according to the invention, and hermetic encapsulation to insulate against environmental influences, such as the penetration of humidity in particular, the effect achieved is that the calibration data remain practically unchanged in spite of the very long OWG and the rough operating conditions. The calibration standard according to the invention, in spite of the simple design, is suitable as a calibration standard for precision instruments.

The hermetic encapsulation of the OWG can be designed, in a particularly advantageous manner, with a sheath formed as a metal tube. Advantageously, the metal tube consists of a corrosion resistant alloy, in particular the so-called refined steel. In such an embodiment, the temperature sensitivity in addition is particularly low.

The ease of operation is improved because the connector element is equipped with coupling places for joining with an optical counter connector. Such coupling elements can be adapted to the connector of an apparatus to be connected or the connector of an optical line leading to the apparatus. Advantageously, there is a coupling portion that can be moved in a spring loaded manner, axially with a respect to the connector element, as is known in the case of high-quality optical connections.

A suitable calibration standard for optical time domain reflect meters (OTDR) should also allow the calibration of the distance indicator. Therefore, according to a particularly advantageous variant of the invention, the OWG provided is a monomode OWG with a damping of at least 0.5 db/km, measured at a wavelength of 1300 nm, and with a length of more than 0.5 km, preferably 2 km, or the OWG is a multimode OWG with a damping of less than 2 db/km, measured at an 850-nm light wavelength, and with a length of more than 0.15 km, preferably 0.5 km. For the calibration of an OTDR it is advantageous if the OWG of the calibration standard presents approximately the same data as optical lines to be measured with the OTDR.

The ends of a metal tube can, in a particularly reliable manner, also be connected with a hermetic seal with a connector pin that is also made of metal.

The simplest and most reliable solution provides for the ends of the sheath to be hermetically-connected with connector elements by means of a plastic introduced in the liquid form, then hardened. Another solution that is particularly good and durable consists of soldering the ends of the metal tube to the connector element. Particularly in the case of metal tube made of refined steel, laser welding is possible using, in particular, a connector element that is also

made of steel or refined steel. In this process, no appreciable amount of heat penetrates into the area of the OWG.

During the optical coupling of the calibration standard to an inlet connector, to prevent the connection processes from having an uncontrolled mechanical effect on the sheath of the OWG and thus an effect on the OWG itself, the connector element provided is fixed in a housing of the calibration standard.

To reliably maintain the windings of the optical line within the housing so that they remain in the same relative position, the sheath provided, which contains the OWG, is wound on a bobbin fixed to the housing and having a diameter of more than 25 cm. Since the OWG inside the sheath is led in a loose manner, the sheath can be fixed, because the forces of fixation cannot have the effect, on the OWG, of increasing the damping.

An advantageous embodiment variant of the invention is explained, with reference to the drawings.

Figure 1 shows a perspective view of the principle of the calibration standard according to the invention.

Figure 2 shows the arrangement of a connector output on the housing of the calibration standard according to Figure 1.

On the bobbin 1, two kilometers of an optical tube 2 are wound. In the winding, the minimum winding diameter should not be less than 25 cm. The bobbin 1 is fixed to the housing 3. The ends of the optical tubes 2 are accessible through connector outputs 4 and 5, and they are applied by the latter to a wall of the housing 3.

The construction of the connector outputs 4 or 5 can be seen in detail in Figure 2. The optical tube 2 consists of an OWG 6, which runs with considerable radial tolerance and with excessive length in a wavy or helicoidal pattern in tubes 7 made of refined steel. The free space in the tubes 7 made of refined steel is filled with a gel-like composition.

The end of the optical tube 2 is hermetically sealed by the connector element 8. The OWG 6 is led up to the front surface of the connector pin 9, which forms the front end of connector element 8, and is coaxially glued therein. The end of the tube 7 made of refined steel is attached by means of a poured hardenable plastic composition 10 in a blind hole attachment 11 of the connector element 8.

The connector element 8 is screwed to the connecting parts 12 of a coupling element. By means of a retaining nut 13, which can be rotated with respect to the connecting part 12, the connector element is screwed via the coupling element to a coupling sheath 14 that carries an external threading. In the process, the line of connector pin 9 extends into a centering guide sheath 15. The coupling sheath 14 extends through a bore of a wall of the housing 3 and is

attached, for example, by means of the lock nuts 16 and 17, one of which could also be designed as the flange of the coupling sheath 14.

The end of the coupling sheath 14, which is accessible outside of the housing 3, can be connected with a mating connector element (not shown) for example, of an OTDR, in such a manner that its connector pin comes in contact with the front surface of the connector pin 9. At least one of the connector pins should be able to axially slide with spring support and in a flexible manner in the guide sheath. The spring-controlled movement of the line of connector pin 9 can be achieved in any desired known manner. In the embodiment example, a retaining nut 13 can be moved away, axially, from the connecting part 12 against a spring force so that, as a result, the line of connector pin 9 can be moved back over a certain distance against this spring force in the guide sheath 15.

CLAIMS

1. Optical calibration standard, which consists of a wound optical tube (2) arranged, with mechanical protection, in a housing (3), and whose ends are accessible through optical connector output (4, 5), characterized in that the optical conductor (2) contains an OWG (6), which is loosely guided and with excessive length inside sheath (7), in that the OWG (6) ends with a hermetic seal in a connector pin (9) of a connector element (8), and in that sheath (7) is connected, with a hermetic seal, to the connector element (8).

2. Calibration standard according to Claim 1, characterized in that the bobbin (1) is a metal tube (7).

3. Calibration standard according to Claim 2, characterized in that the metal tube (7) is made of a corrosion resistant alloy, in particular, of a so-called refined steel.

4. Calibration standard according to Claims 1-3, characterized in that the connector element is equipped with coupling parts (12, 13) for connecting with an optical mating connector.

5. Calibration standard according to Claim 4, characterized in that coupling part (13) can be moved axially with respect to the connector element (8).

6. Calibration standard according to one of Claims 1-5, characterized in that the OWG (6) is a monomode OWG with a damping of at least 0.5 db/km, measured at a light wavelength of 1300 nm, and with a length of more than 0.5 km, preferably 2 km.

7. Calibration standard according to one of Claims 1-5, characterized in that the OWG (6) is a multimode OWG with a damping of at least 2 db/km, measured at a light wavelength of 850 nm, and with a length of more than 0.15 km, preferably 0.5 km.

8. Calibration standard according to one of Claims 1-7, characterized in that the ends of the sheath (7) are hermetically connected to the connector element (8) by means of a plastic that is introduced in the liquid form, then hardened.

9. Calibration standard according to one of Claims 2-7, characterized in that the ends of the metal tube (7) are soldered to the connector element (8).

10. Calibration standard according to one of Claims 2-7, characterized in that the ends of the metal tube (7) are laser welded to the connector element (8).

11. Calibration standard according to one of Claims 1-10, characterized in that the connector element (8) is attached to a housing (3) of the calibration standard.

12. Calibration standard according to one of Claims 1-11, characterized in that the sheath (7) containing the OWG (6) is wound on a bobbin (1), which is fixed to the housing (3) and which has a diameter of more than 25 cm.

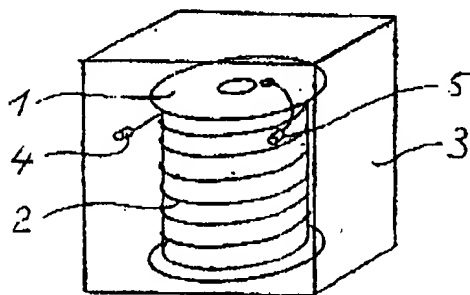


Figure 1

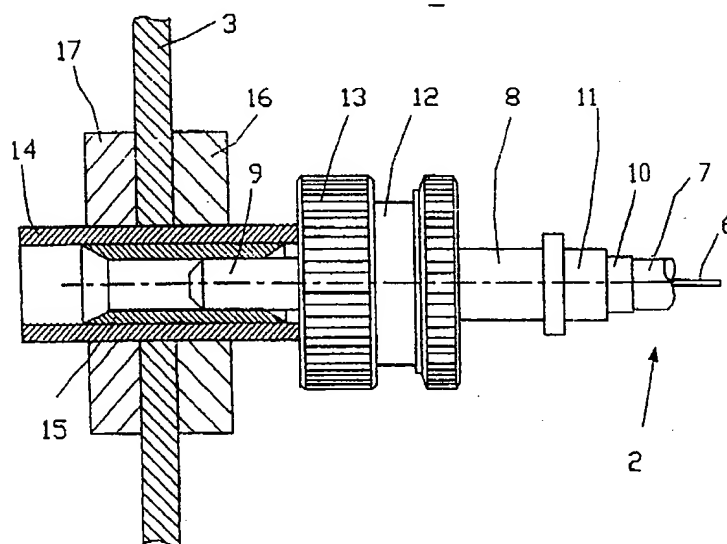


Figure 2

PHOENIX

TRANSLATIONS

...the height of Excellence...

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